TABLE 1. Practices to maximize student learning from educational videos

Element to consider	Recommendation	Rationale	Examples
Cognitive load	Use signaling to highlight important information.	Can reduce extraneous load. Can enhance germane load.	Key words on screen highlighting important elements Changes in color or contrast to emphasize organization of information Changes in color or contrast to emphasize relationships within information Brief out-of-video text explaining purpose and context for video (e.g., learning objective for video)
	Use segmenting to chunk information.	Manages intrinsic load. Can enhance germane load.	Short videos (6 minutes or less) Chapters or click-forward questions within videos
	Use weeding to eliminate extraneous information.	Reduces extraneous load.	Eliminating music Eliminating complex backgrounds
	Match modality by using auditory and visual channels to convey complementary information.	Can enhance germane load.	Khan Academy–style tutorial videos that illustrate and explain phenomena Narrated animations
Student engagement	Keep each video brief.	Increases percentage of each video that students watch; may increase total watch time. May decrease mind wandering.	Multiple videos for a lesson, each ≤ 6 minutes
	Use conversational language.	Creates a sense of social partnership between student and instructor, prompting the student to try harder to make sense of the lesson.	Placing the student in the lesson by use of "your" rather than "the" during explanations Use of "I" to indicate the narrator's perspective
	Speak relatively quickly and with enthusiasm.	Increases percentage of each video that students watch. May increase sense of social partnership between student and instructor.	Speaking rates in the 185–254 words per minute range Expressions of instructor excitement, such as "I love the next part; the way the feed-forward mechanism works is so elegant," or "Consider how the cell solves this tricky problem of needing to regulate three genes in sequence; it's really cool."
	Create and/or package videos to emphasize relevance to the course in which they are used.	Increases percentage of each video that students watch. May increase germane cognitive load by helping students recognize connections.	Videos created for the class in which they are going to be used, with instructor narration explaining links to preceding material Explanatory text to situate video in course
Active learning	Consider these strategies for promoting active learning:		
	Packaging video with interactive questions.	May increase germane cognitive load, improve memory via the testing effect, and improve student self-assessment.	Integrate questions into videos with HapYak or Zaption, as described by Obodo and Baskauf (2015) Follow short videos with interactive questions within an LMS, as done by Keithly and colleagues (2015), or within Google Forms, as done by Caudel and colleagues (2015)
	Use interactive features that give students control.	Increases student ownership and may increase germane cognitive load.	Create "chapters" within a video using HapYak or YouTube Annotate
	Use guiding questions.	May increase germane cognitive load, reduce extraneous cognitive load, and improve student self-assessment.	Senchina (2011) provides guiding questions for videos designed to introduce physiology students to professional ethics related to experimenter–subject interactions, such as the following: "Observe the subject's behavior and responsiveness during the dehydration period. What changes as the subject becomes dehydrated? What problems does he have? Observe the experimenters' behavior and responsiveness as dehydration progresses. What do they do differently? Why?"
	Make video part of a larger homework assignment.	May increase student motivation, germane cognitive load, and student self-assessment.	Package videos with a series of questions or problems that ask students to apply the concepts from the videos. iBiology Education videos (e.g., *What Can You Learn with a Light Microscope?*) provide one example (iBiology, 2016)